

Office of Independent Environment, Safety, and Health Oversight
Environment, Safety and Health

Independent Review of the

*Open Burning Event at the
Environmental Management
Waste Management Facility
Construction Site*

Oak Ridge Reservation

April 2001



Table of Contents

EXECUTIVE SUMMARY	1
1.0 PURPOSE	3
2.0 BACKGROUND AND EVENT DESCRIPTION	4
3.0 ON SITE REVIEW ACTIVITIES	7
4.0 RESULTS	7
4.1 Hazard Identification and Controls	7
4.2 Roles and Responsibilities	8
4.3 Incident Response	11
4.4 Event Notification	12
4.5 Event Reporting	12
5.0 OPPORTUNITIES FOR IMPROVEMENT	14
APPENDIX-TEAM COMPOSITION	16

Abbreviations Used in This Report

AHA	Activity Hazards Analysis
BJC	Bechtel Jacobs Company
CCI	CH ₂ M Hill Constructors, Incorporated
DFS	Duratek Federal Services
DOE	U.S. Department of Energy
EH-2	Office of Independent Environment, Safety, and Health Oversight
EMWMF	Environmental Management Waste Management Facility
ES&H	Environment, Safety, and Health
OR	Oak Ridge Operations Office
ORNL	Oak Ridge National Laboratory
ORR	Oak Ridge Reservation
PSS	Plant Shift Superintendent
TDF	Tennessee State Division of Forestry

OVERSIGHT

Executive Summary

Background

This report documents the results of an onsite review performed by the U.S. Department of Energy Office of Independent Environment, Safety, and Health Oversight, within the Office of Environment, Safety and Health, from February 20-22, 2001. The purpose of the review was threefold: (1) to examine conditions associated with the February 8, 2001, open burning event¹ at the construction site of the Environmental Management Waste Management Facility on the Oak Ridge Reservation; (2) to assess the effectiveness of fire safety features and programs designed to prevent an open burning event; and (3) to identify opportunities for improvement to prevent recurrence. The Department of Energy Oak Ridge Operations Office, the Bechtel Jacobs Company, and a series of contractors are responsible for ensuring effective implementation of all activities associated with the safe construction of the Environmental Management Waste Management Facility. Upon completion, the Environmental Management Waste Management Facility will be an engineered earthen disposal cell with cap for the above-ground storage of polychlorinated biphenyl-contaminated, low-level radioactive, hazardous, and mixed wastes. Duratek Federal Services, a principal subcontractor to Bechtel Jacobs Company, has overall responsibility for the design, construction, and operation of the Environmental Management Waste Management Facility, and will operate the facility upon completion. CH₂MHill Constructors, Incorporated, a principal subcontractor to Duratek Federal Services, is responsible for facility design and construction management. Avisco, a principal subcontractor to CH₂MHill Constructors, Incorporated, is tasked with facility construction.

¹ In this report, the term "open burning" refers to the controlled reduction by fire of piled materials from clearing and grubbing activities in an open area. "Open burning event" refers to the subsequent ignition of underbrush and debris (i.e., slash) from prior logging operations as a result of flying brands (i.e., burning embers) from the burn piles.

Description of Event

On February 8, 2001, a small brush fire was observed between Pine Ridge and Haul Road, approximately one mile west of the main Y-12 National Security Complex on the Oak Ridge Reservation. The fire occurred as a result of land clearing ("or grubbing") operations associated with construction of the Environmental Management Waste Management Facility. The work involved forming piles of brush and tree stumps using earth moving and other mechanized equipment. The piles were ignited using diesel fuel and were burned until the accumulated combustibles were consumed. The brush fire occurred when a gust of wind transported brands (i.e., burning embers) from one pile across a pre-established clear space (or buffer zone) into adjoining woodland. The woodland area beyond the buffer zone border contained debris (i.e., slash) from earlier logging activity. The fire spread up and along the sloped terrain and eventually consumed two acres of brush; an additional acre burned as part of a "backfire" that was set to contain the fire.

In response to the emergency, Avisco employees created "firebreaks," the Y-12 Plant Fire Department established incident command, and the Tennessee State Division of Forestry lighted a backfire. These activities were credited with containing the fire, which was reported under control after approximately six hours. One Avisco employee suffered a minor burn to the top of his right ear; he was administered first aid and released. There was no significant property loss and no radiological release or other adverse consequences associated with the fire.

Results of Review

Generally, the emergency response to the open burning event was effective. However, a number of weaknesses in fire safety were identified in hazard identification and controls, roles and responsibilities, training and competency, incident response, and event notification and reporting.

The presence of an on-scene safety official and the efficient establishment of incident command by the Y-12 Plant Fire Department Battalion Chief contributed to a coordinated fire response. The Common Response Agreement with the Tennessee State Division of Forestry facilitated the division's timely response. The Y-12 Plant Fire Department arrived quickly at the site following proper notification by the Y-12 Plant Shift Superintendent, a BWXT Y-12 LLC employee. Prompt notifications of Oak Ridge Operations Office and Bechtel Jacobs Company managers also resulted in a rapid response by appropriate managers from those organizations.

Weaknesses found in hazard identification and controls included an incomplete assessment of fire hazards associated with the land clearing activity, insufficient involvement of fire safety subject matter experts in the review of project activities, inadequate fire protection features to mitigate the hazards, and a lack of implementation of the Oak Ridge National Laboratory Forestry Management Group procedure for open burning. Because the open burning event was associated with a privatized activity, the Department neither prescribed the burn methods to be used nor identified unique hazards and specific safeguards to be applied to this particular activity. Additionally, the Y-12 Plant Fire Department did not have a complete inventory of wildland fire safety gear, such as appropriate boots and chain saws, which limited its effectiveness as first responder.

Weaknesses in communication within the multi-level organizational structure for the Environmental Management Waste Management Facility project complicated the process of implementing a comprehensive and effective safety program. Responsibility for safety is distributed among four contractors and the Department of Energy. Safety responsibilities were not completely documented and uniformly understood. Fire watch personnel were inappropriately assigned collateral duties and did not use proper fire equipment. Department of Energy and Bechtel Jacobs Company oversight personnel did not receive site-specific training in open fire burning techniques, associated fire prevention, and firefighting.

In addition, Duratek Federal Services oversight personnel were unfamiliar with some activity hazards analysis requirements, and bulldozer operators were not formally trained to support fire control.

Conclusion

More than a decade ago the Oak Ridge Reservation mission was augmented with significant waste management and environmental restoration goals. This open burning event indicates that certain personnel are inadequately equipped (with the requisite training and tools) to perform effective wildland fire safety activities associated with the cleanup and construction activities related to this augmented mission. Although the event resulted in no significant adverse consequences, it revealed that weaknesses exist in the application of integrated safety management at the Environmental Management Waste Management Facility project. While the open pile burning activity did not come under the Department's moratorium on prescribed burning actions, the reaction of the Oak Ridge Operations Office to the moratorium memorandum lacked sensitivity to the fire safety issues contained therein. Management and workers did not acknowledge or adapt lessons learned from year 2000 wildfires. Potential hazards inherent in "customary" operations were not adequately addressed, and the Oak Ridge Operations Office did not completely fulfill its responsibilities to delineate an acceptable safety standards set that would govern burn operations associated with construction activities. Additionally, because design, construction, and operation of the Environmental Management Waste Management Facility is a privatized project, the Oak Ridge Operations Office did not prescribe all of the hazard controls that were required to be used in conducting the work. Consequently, the contractors at the Environmental Management Waste Management Facility project may have employed a less conservative safety approach to burning activities than was applied to similar land-clearing operations associated with construction of the Spallation Neutron Source, where the Oak Ridge Operations Office assumed its customary project responsibilities. This open burning event provides a number of lessons learned that the Oak Ridge Reservation should apply.

1.0

Purpose

The U.S. Department of Energy (DOE) Office of Independent Environment, Safety, and Health Oversight (EH-2), within the Office of Environment, Safety and Health, reviewed the circumstances associated with the February 8, 2001, open burning event at the Environmental Management Waste Management Facility

(EMWMF) construction site on the Oak Ridge Reservation (ORR). The review focused on evaluating the effectiveness of fire safety systems and programs designed to properly manage open burning events, and to identify opportunities to prevent recurrence. A map showing the location of the EMWMF and the surrounding area is provided in Figure 1.

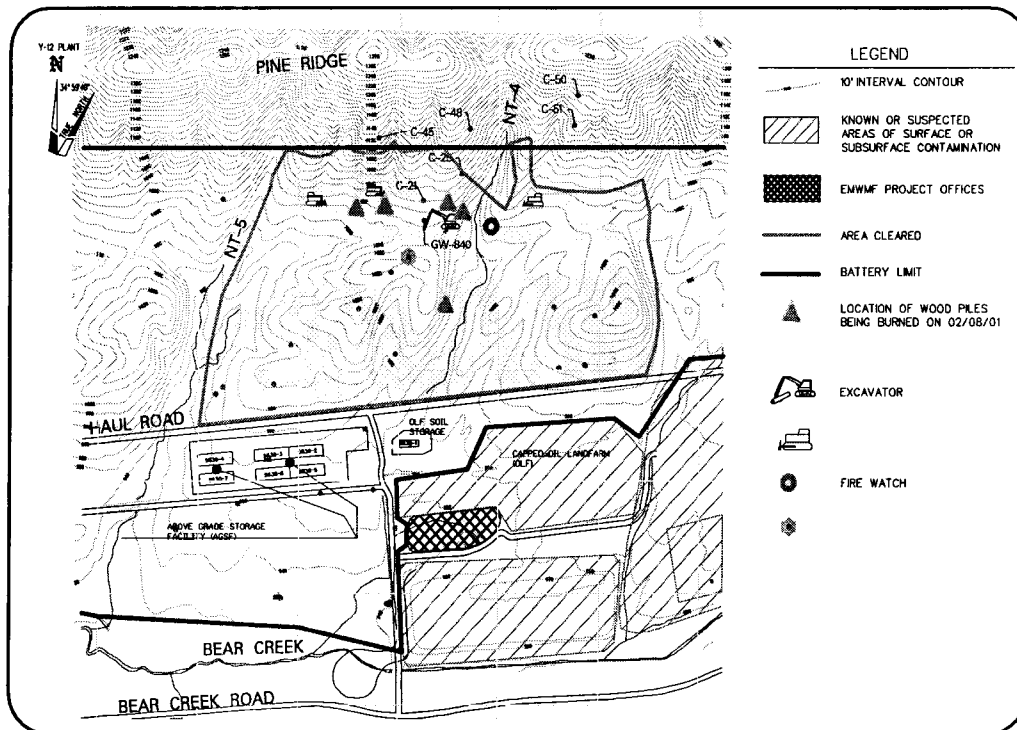


Figure 1. Pre-burning Event Conditions at the Environmental Management Waste Management Facility Construction Site

The DOE Headquarters Office of Science is the "landlord" for the ORR, and the Office of Environmental Management has lead program responsibility for the EMWMF project. Line management of the EMWMF project is a DOE Oak Ridge Operations Office (OR) responsibility. Bechtel Jacobs Company (BJC) provides Reservation-wide environmental restoration and waste management support to OR. As part of DOE's privatization initiative at the ORR (where private industry is directly involved in cleanup operations), BJC has contracted with Duratek Federal Services (DFS) to oversee the safe design, construction, and operation of the EMWMF. CH₂MHill Constructors, Incorporated (CCI) is a subcontractor to DFS providing design and engineering support. Avisco is a subcontractor to CCI providing construction support.

The Y-12 Plant Fire Department is the designated first responder in the event of a fire emergency at the EMWMF project site. Under a mutual aid common response agreement, the Tennessee State Division of Forestry (TDF), the Oak Ridge National Laboratory (ORNL) Forestry Management Group, and the ORNL Fire Department provide technical support to the first responders in the event of a fire emergency. Prior to initiation of construction activities, OR surveyed the EMWMF area and determined that no hazardous materials were present.

DOE Moratorium on Prescribed Burns

In 2000, DOE experienced a number of significant wildland fires at its sites. The most notable was the Cerro Grande fire that caused considerable damage to the Los Alamos National Laboratory and the adjoining community. Addressing the "lessons learned" from these fires and recognizing that potential future vulnerability exists, the Department undertook a multi-faceted fire safety initiative. This initiative includes performing an initial wildland fire safety review, creating an advisory commission on fire safety and

preparedness, developing directives on wildland fire management, and conducting a comprehensive review of fire protection programs at selected sites.

In May 2000, the Deputy Secretary of Energy verbally imposed a 30-day moratorium on prescribed burning that applied to land management actions. Subsequently, on June 5, 2000, he issued a memorandum that imposed a Department-wide moratorium on prescribed fires but did not explicitly preclude other controlled-burn actions, such as open-air burning. Implementing this memorandum caused some confusion within OR and its contractors, who asked DOE Headquarters for interpretations on the applicability of the moratorium, the need for an exemption, and definition of terms. While the terms "prescribed fire" and "controlled burn" are often used interchangeably, at ORR the term "controlled burn" applies to a range of activities, including pit burning, pile burning, and similar open-air burning activities in support of construction operations. Such burns have unique attributes (such as piled combustibles and buffer zones) that are not characteristic of prescribed fires related to wildland management. As indicated by this event, however, both types of burning can adversely impact the wildlands. Although the original directive imposing the moratorium did not address the spectrum of open air burning that is routinely conducted across the Department, the need to implement appropriate fire safety precautions to avoid further out-of-control fires is evident.

Event Description

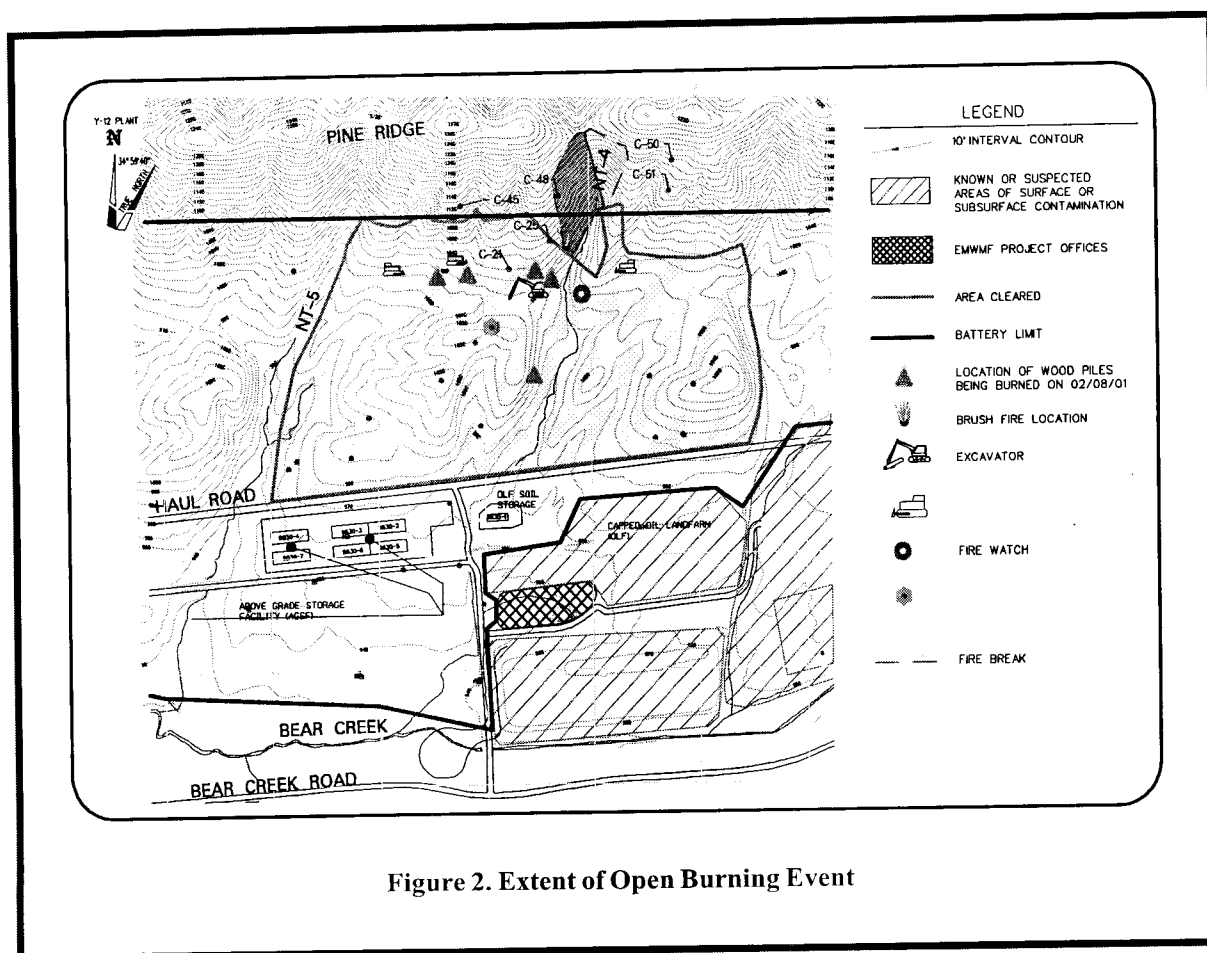
On February 8, 2001, Avisco personnel were conducting open pile burning about one mile west of the Y-12 National Security Complex to reduce the volume of stumps and brush that had been cleared from the EMWMF construction site. The pile burn was being performed under permit number 01-BL37 obtained by Avisco from the TDF. The stumps and brush were collected in piles before being ignited using diesel fuel. A Caterpillar 320 hydraulic excavator (similar to a trackhoe) was

adding wood fuel to the pile fire; four additional nearby piles were burning concurrently. Fire watch personnel monitored all burning piles while also performing other activities.

At approximately 1:45 p.m., a fire started on the north ridge when a gust of wind carried brands (i.e., burning embers) north from a burning pile, and ignited slash from previous logging operations and, in turn, dry leafy material at the base of the ridge. The natural chimney effect caused by the topography helped carry the fire up the ridge. Avisco's fire watch personnel promptly contacted the Avisco project supervisor, who immediately responded to the emergency, and directed CCI and DFS to make initial notifications to BJC who, in turn, contacted the Y-12 Plant Shift Superintendent (PSS), a BWXT Y-12 LCC employee. The Y-12 PSS then notified the Y-12 Plant Fire Department and the Oak Ridge Operations Center. Incident command was

assumed by the Y-12 Plant Fire Department, who maintained radio contact with the Y-12 PSS as events were unfolding. The ORNL Forestry Management Group, TDF, and the ORNL Fire Department personnel were asked by the on-scene incident commander to respond and provide support.

Avisco bulldozer operators cut firebreaks while the Y-12 Plant and ORNL Fire Departments provided technical assistance. The TDF recommended cutting another firebreak and set a backfire to contain the fire. As a result of these efforts, the fire was initially contained by 3:12 p.m. and declared out by 8:00 p.m., having consumed two acres of wooded area, with an additional acre burned as part of the backfire. A fire watch was maintained during the night and for the next three days. (See the text box for a more detailed description of the event, and Figure 2 for a depiction of the extent of the burn area.)



TIMELINE OF PRINCIPAL EVENTS

FEBRUARY 8

- 1345 On-scene personnel from DFS, CCI, and Avisco observe a large plume of smoke on the north side of the EMWMF project site and immediately move to that location to assess the situation; Avisco fire watch personnel notify the Avisco EMWMF project supervisor, who in turn directs CCI and DFS to make the initial notifications to BJC.
- 1347 DFS personnel notify BJC that the fire has spread from a burning wood debris pile to the ridge on the north side of EMWMF project site; BJC, in turn, notifies the Y-12 PSS (a BWX Technologies employee) who then notifies the Y-12 Plant Fire Department.
- 1350 Avisco project supervisor directs bulldozer operators to cut the initial firebreak.
- 1400 Y-12 Plant Fire Department arrives and assumes incident command.
- 1430 DFS directs CCI to suspend construction activities at the above-ground storage facility (AGSF) relocation area at the EMWMF project site. The fire event is categorized as an off-normal occurrence by the EMWMF Manager.
- 1435 An ORNL Forestry Management Group Representative arrives at the site and reviews firebreaks.
- 1512 The incident commander reports to OR, TDF, BJC, and DFS that the fire is contained.
- 1515 The incident commander calls the ORNL Fire Department and requests additional mobile apparatus as a preventive measure.
- 1540 ORNL Fire Department arrives.

New Fire Threat

- 1600 Fire jumps the existing firebreak.
- 1604 Incident commander directs Avisco personnel to respond to the new fire by cutting another firebreak.
- 1618 CCI reports that the fire on top of the ridge is contained.
- 1715 A TDF representative arrives and recommends cutting a new firebreak to the east of the existing line in a north-south direction; Avisco's bulldozer operator cuts the firebreak.
- 1735 All nonessential emergency personnel are evacuated from the ridge as a safety measure.
- 1745 Three TDF representatives set a backfire.
- 1756 Oak Ridge Operations Center notifies DOE Headquarters Emergency Operations Center about the current status of the fire.
- 1800 An Avisco bulldozer operator receives first aid treatment for burns on his right ear and smoke in his eyes, sustained while cutting the last firebreak.

Recovery Activities

- 1830 Avisco personnel position floodlights to facilitate on-scene activities; CCI and Avisco deploy three fire watch personnel, a bulldozer operator, and a supervisor to monitor the backfire through the night.
- 2000 Incident commander declares fire out, with concurrence from TFD, the ORNL Forestry Management Group, and the Y-12 Plant and ORNL Fire Departments.

FEBRUARY 9

- OR suspends burning activities throughout the site.
- 1200 Avisco workers remain at the project site.
- 1300 Incident commander conducts critique with OR, BJC, DFS, and ORNL Forestry Management Group.
- 1449 Off-normal notification completed in Occurrence Reporting and Processing System.
- 1530 Dedicated fire watch personnel return to the site and remain throughout the night in accordance with the EMWMF activity hazard analysis.

FEBRUARY 10 and 11

No work is performed and a 24-hour fire watch continues.

3.0 Onsite Review Activities

The onsite portion of this review was conducted from February 20-22, 2001, and included document reviews, interviews, inspection of the fire site, and examination of the application of relevant policies and controls to the planning and conduct of the burn activity. Activities were focused on understanding and evaluating implementation of hazard identification and controls, roles and responsibilities, training and competency, incident response, and event

notification and reporting protocols. More than 50 personnel from OR, TDF, the ORNL Forestry Management Group, the ORNL and Y-12 Plant Fire Departments, BJC, DFS, CCI, and Avisco were interviewed, and more than 50 documents and records were examined. Daily debriefings were conducted with site personnel to share information and observations developed by the review team. The team leader conducted a formal debriefing for ORR personnel at the close of the team's onsite activities.

4.0 Results

This independent review of the circumstances of the open burning event of February 8, 2001, characterizes the positive attributes (strengths) and observations (weaknesses) associated with the fire safety features and programs designed to mitigate the open burning event at the EMWMF construction site.

4.1 Hazard Identification and Controls

Observations

- **The scope of the fire hazards addressed in the activity hazards analyses (AHAs) was incomplete.**

The identification of work to be performed and its relation to fire hazards (among other safety and health risks) is delineated in an activity hazards analysis (AHA) that is developed with input from workers and other site personnel. Workers are trained using the AHAs displayed at the job site. For each hazard identified in the AHA, corresponding "hazard controls" are delineated.

The process currently used to identify fire hazards lacks rigor and completeness. Although AHAs are required to include an "analysis" of

hazards, the governing AHA for this work merely lists the individual hazards, and does not include a documented evaluation. For example, although the phrase "uncontrolled fire" is identified, there is no evidence that an uncontrolled fire in adjoining woodlands was considered.

The governing AHA developed by DFS for "clearing and grubbing activity" (CONST-03-004, Rev 3, and attachments) addresses a number of work activities that involve fire hazards, including the refueling of equipment and the ignition of brush piles. However, the AHA does not identify all credible fire hazards associated with the grubbing activity (including the risks from wind and from wind-generated burning embers) or safeguards to prevent credible fire hazards. Furthermore, there are no procedures for establishing the various weather conditions under which burning activities should be curtailed, or for obtaining burning conditions from the Y-12 PSS to monitor continuation of activities. Responsible line management did not ensure that the AHAs include an evaluation of all credible hazards associated with an activity, and that they are documented accordingly.

- **Fire safety and wildland management subject matter experts were not involved in developing the AHAs.**

Although workers and site personnel provided input, neither fire safety nor wildland management specialists were formally involved in the development, review, and implementation of the AHA, or in the performance or oversight of work at the EMWMF construction site. This is inconsistent with contractual agreements, as the BJC and Avisco procedures for governing hazard reviews and related responsibilities require the involvement of subject matter experts.

- **Appropriate features and controls to mitigate fire hazards were not identified in the AHAs.**

For each hazard identified in the AHA, a range of mitigating features is delineated, such as the stipulation that fuel trucks be positioned at least 50 feet away during ignition of brush piles. However, some important fire protection safeguards and controls are not identified in the AHA. For example, the AHA does not refer to the need for a combustible-free clear space or buffer zone. A 68-yard buffer area existed at the time of the fire, but its border was cluttered with brush debris (i.e., slash) from prior logging operations; the fire initially occurred in this slash material, which was outside of the clearing and grubbing area. (The slash remaining around the proposed construction site continues to be a fire hazard.) Additionally, no safeguards were identified to compensate for excessive wind gusts during burning, and discharging earth onto a burning pile was not considered as a hazard control.

ACTIVITIES AT THE SPALLATION NEUTRON SOURCE CONSTRUCTION SITE

Similar grubbing operations at the construction site for the Spallation Neutron Source featured a 100-yard buffer zone. Avisco performed the land clearing for this project. The ORNL Forestry Management Group provided Avisco with a hydro-seeder that was capable of discharging pressurized water onto the burning piles and the adjoining woodland. Vegetation was reduced through the use of forced-air combustion in trenches or pits.

The AHA identifies the need for a fire watch as a hazard control for "uncontrolled fires." However, during a routine visit on February 7, 2001, the DOE Facility Representative noted that a dedicated fire watch was not in place, and the individual tasked to perform the fire watch was working elsewhere on the site. This situation, which was observed by the OR Facility



Burn Piles Prior to Fire Event

Representative on the day prior to the event, was quickly brought to the attention of the DFS Site ES&H Representative.

The AHA identifies no response role for equipment operators in the event that a burn pile gets out of control. Nevertheless, when a gust of wind transported a brand across the buffer zone and ignited slash and dry leaves, the Avisco supervisor acted beyond his authority and directed bulldozer operators and other workers to create firebreaks ahead of the fire. Based on interviews conducted by the review team, these workers discounted the potential risk to their personal safety. The operators and other workers performed these emergency response activities despite their lack of fire-related protective equipment, the absence of appropriate safety features on the motorized equipment, and the lack of formal training in fire emergency response. Unnecessary risks to personnel could have been avoided with effective planning, training, and appropriate firefighting equipment.

RESPONSE TO OPEN BURNING EVENT

BJC was proactive in attempting to investigate the root cause of this event and is addressing noted weaknesses by revising the AHA, adopting enhanced fire safety measures, and through other remedies.

4.2 Roles and Responsibilities

Observations

- **Fire safety responsibilities for EMWMF project personnel at ORR are not formally documented or uniformly understood.**

Organizations and associated personnel having oversight and emergency response duties associated with the EMWMF project are summarized in Table 1. Some personnel were not fully effective in their assigned roles because their responsibilities were not clearly defined, and their competence was not necessarily commensurate with assigned duties. In some cases, capable individuals performed tasks outside their authority because their authorities were neither defined contractually nor delineated in the AHA and emergency plans. Organizational roles and responsibilities are depicted in Figure 3.

Although not specifically required by either DOE orders or contractual agreement, the formally defined responsibilities of the OR Facility Representative, and

the BJC safety advocate and subcontract technical representatives do not specifically include the “non-facility” operating environment and the hazards associated with open burning at the EMWMF construction site. Further, these personnel have not received formal site-specific training in pile burning techniques and associated fire prevention and firefighting techniques to ensure effective execution of their oversight responsibilities. However, before the open burning event, the BJC safety advocate correctly identified weaknesses in containerization of diesel fuel used for starting pile fires; this recognition subsequently resulted in a revision of the AHA. Additionally, the DFS and CCI site ES&H representatives responded effectively to the fire emergency.

Table 1. Principal Organizations and Personnel with Responsibilities Associated with the Open Burning Event

Organization	Personnel	Oversight and Emergency Response Duties
Headquarters Office of Science	Program Managers	Program direction of ORR activities
Headquarters Office of Environmental Management	Program Managers	Project funding, direction, and oversight
Oak Ridge Operations Office	Facility Representatives and Subject Matter Experts	Oversight of all EMWMF project contractor and subcontractor operations
Bechtel Jacobs Company	Subcontract Technical Representatives, ES&H Manager, and Safety Advocates	Oversight of EMWMF project prime subcontractor and lower-tier subcontractors
Duratek Federal Services	ES&H Representative and Site ES&H Representative	Oversight of all EMWMF project subcontractors
CH ₂ MHill Constructors, Incorporated	Field Engineer and Site ES&H Representative	Oversight of EMWMF project construction subcontractors
Avisco	Foremen, Supervisors, Operators, and Laborers	Fire watch
Y-12 Plant Fire Department	Firefighters	First responders to events
Oak Ridge National Laboratory Forestry Management Group	Subject Matter Expert in forestry management and firefighting	Technical support to first responders
Oak Ridge National Laboratory Fire Department	Firefighters	Technical support to first responders
Tennessee State Division of Forestry	Firefighters	Technical support to first responders

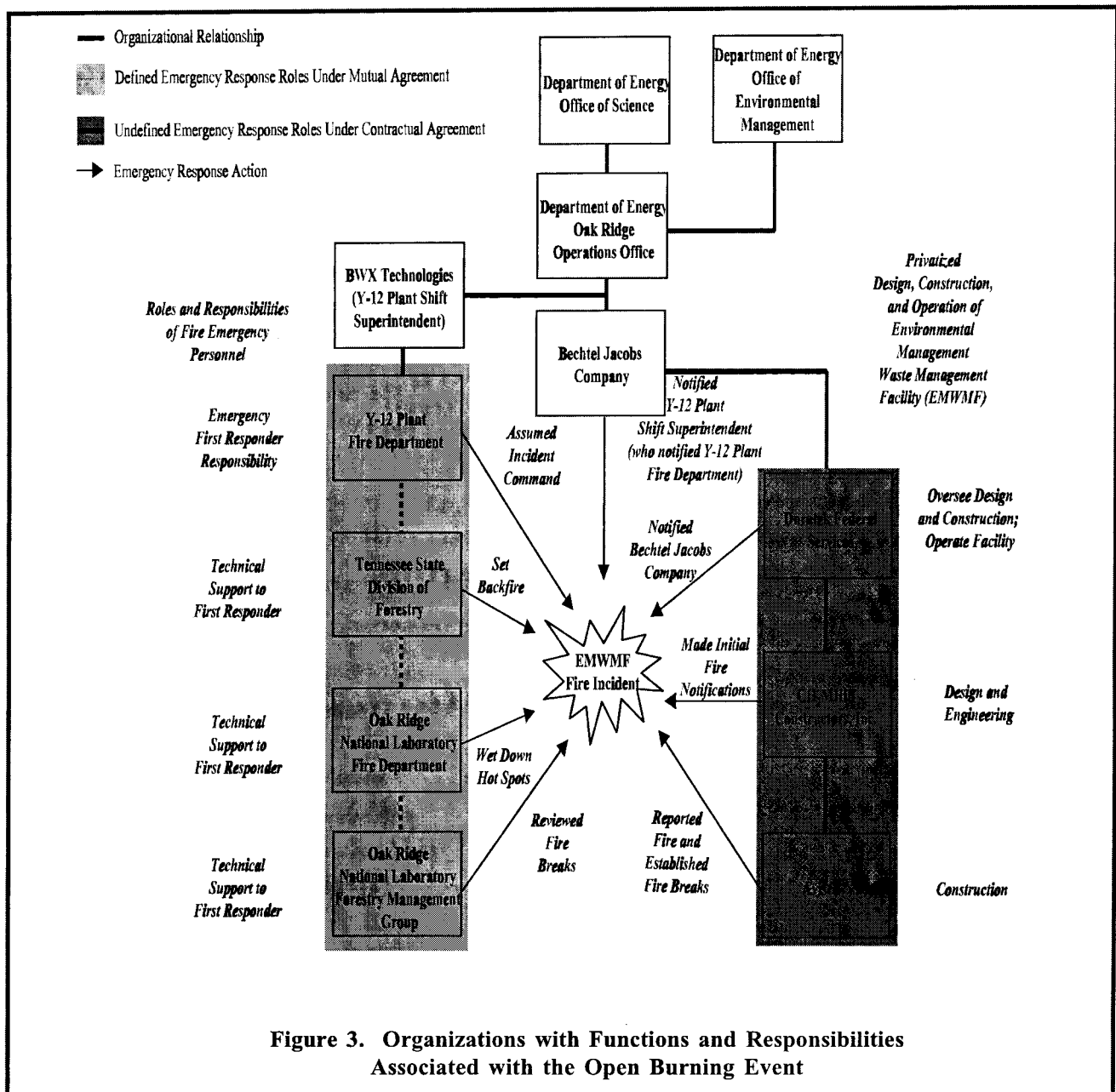


Figure 3. Organizations with Functions and Responsibilities Associated with the Open Burning Event

- **Insufficient understanding of and compliance with the current AHA were detrimental to the execution of safety responsibilities.**

The DFS (EMWMF) site ES&H representative demonstrated an insufficient understanding of fire watch requirements contained in the AHA, as the Avisco supervisor was permitted to assign collateral activities to daytime Avisco fire watch personnel. As mentioned

previously, the DOE Facility Representative noted on February 7, 2001, that a dedicated fire watch was not in place and the assigned individuals were working elsewhere on the project site. At the time the fire initially spread to the nearby wooded area, Avisco fire watch personnel continued to perform their collateral duties attending to a tear in a silt fence approximately 150 feet from the two suspect burn piles (responsible for the brands that ignited the slash).

- **Fire safety responsibilities contained in the AHA and emergency plan for EMWMF construction operations are either inconsistent with current capabilities or not defined for certain personnel.**

Avisco bulldozer operators were directed by their supervisor to respond to the event by cutting firebreaks to contain the fire before the arrival of the Y-12 Plant Fire Department. This action is not a defined responsibility for these Avisco personnel in the AHA and emergency response plan, and, therefore, they would not have received any prior emergency response training and certification. Although their performance was effective, workers' actions did place them at risk.

4.3 Incident Response

Positive Attributes

- **Incident command was established rapidly, response activities were generally effective, and functions were well-coordinated among participating organizations.**

Upon arriving at the scene, the Y-12 Plant Fire Department Battalion Chief assumed incident command, and a command post was maintained for the duration of the event. The post coordinated activities among the responding organizations, efficiently monitored the firefighting activities, and established communication, safety, and personnel staging areas, as required. Additional personnel responded from three other fire organizations – the ORNL Forestry Management Group, the TDF, and the ORNL Fire Department. Throughout the fire, the incident commander maintained control and ensured proper personnel staging and accountability.

The on-scene ORNL Forestry Management Group subject matter expert examined the firebreaks created by Avisco, and continued to provide technical support to the incident commander. The ORNL Fire Department subsequently responded and provided assistance by wetting down hot spots. The TDF responded quickly with a well-trained and equipped four-person crew. The TDF recommended that an additional firebreak be cut on the ridge areas and set a backfire to help consume all the fuel within the established fire area. The TDF used chain saws to cut trees and keep all burning fuel within the established area. All firefighting crews maintained surveillance of the area until released by the incident commander.

Observations

- **An emergency action plan has not been developed in accordance with Occupational Safety and Health Administration requirements.**

Section 1926.35 of the Occupational Safety and Health Act (OSHA) requires emergency action plans to include "designated actions employers and employees must take to ensure employee safety from fire and other emergencies." This requirement has been inappropriately excluded from the construction site's Work Smart Standards set, which therefore does not address the full range of hazards.

Fire safety roles for EMWMF project personnel are not clearly defined in the existing emergency plan; thus, personnel did not receive proper training in appropriate emergency response actions, accountability, and communications.

Subcontractor personnel were not properly trained in specific actions to ensure their safety from fire or other related emergencies. Furthermore, subcontractor personnel responding to the fire had no formal means or training to establish accountability and to ensure that adequate communications were provided.

- **The Y-12 Plant Fire Department is currently not properly equipped for wildland fires.**

Primary responsibility for wildland fire control at the ORR resides with the ORNL Forestry Management Group and the TDF, as delineated in the ORR Common Response Plan. Although trained by the TDF in wildland fire response, and assigned first responder responsibility for the EMWMF project site, the Y-12 Plant Fire



Emergency Responders

Department currently does not have all of the equipment necessary to address wildland fires. Consequently, the incident commander was limited in his ability to utilize Y-12 Plant Fire Department personnel to control the brush fire.

4.4 Event Notification

Positive Attributes

- **Prompt and proper notification of the Y-12 PSS resulted in a quick emergency response by the Y-12 Plant Fire Department.**

After the Avisco fire watch discovered the wildland fire at the EMWMF construction site, the Avisco project supervisor quickly responded to the emergency and directed CCI and DFS personnel present at the site to notify BJC, who in turn notified the Y-12 PSS. The Y-12 PSS then made the appropriate and timely notifications to the Y-12 Plant Fire Department, to appropriate OR and BJC personnel, and to the DOE Oak Ridge Operations Center.

Based on the available information, the EMWMF Manager properly categorized the event as off-normal, with the nature of the occurrence defined as a Cross-Category (10), Potential Concerns/Issues (C). Categorization was completed about 45 minutes after event initiation, which is within the time requirements specified in DOE Order 232.1A, *Occurrence Reporting and Processing of Operations Information*. Although not required by this order, the Oak Ridge Operations Center notified the DOE Headquarters Emergency Operations Center approximately four hours into the event.



Backfires

Throughout the event, the Y-12 PSS informed the Oak Ridge Operations Center of significant changes in event status; the Oak Ridge Operations Center, in turn, provided event status updates to the DOE Headquarters Emergency Operations Center. The ETTP PSS submitted the off-normal notification on February 9, 2001, as Occurrence Report ORO-BJC-Y12WASTE-2001-0002. This timing for event categorization and issuance of the notification report were consistent with DOE Order 232.1A. The Occurrence Report was updated on February 15, 2001, to reclassify the nature of the occurrence to Facility Condition (1), Fires/Explosions (B), and to document that an OR directive prohibiting open burning was issued on February 9, 2001.

4.5 Event Reporting

Observations

- **The follow-up critique for the event was not conducted in accordance with BJC requirements.**

Although some elements of the February 9, 2001, critique were performed properly, other key requirements specified in BJC Procedure SPP-1333, *Conducting Critiques*, were not met. For example, some participants in the burning event were not given the opportunity to present their observations during the critique. The critique did not focus on the facts of the event and did not address the emergency response. In addition, at the time of this review, the critique report was in draft form and had not been provided to the ETTP PSS as required. BJC management had not performed the post-critique task of ensuring the correct categorization of the event and its nature of occurrence.

- **The Occurrence Report was not updated after significant new event information became available.**

As a result of the February 9, 2001, critique, new information was developed and documented in the critique report. However, this information was not provided in the Occurrence Report update in accordance with DOE Order 232.1A. The new information included the ineffectiveness of the AHA, a minor (first aid) injury suffered by an Avisco bulldozer operator, and equipment



Firebreaks to Contain Fire

problems encountered by the Y-12 Plant Fire Department.

- **An evaluation of new information suggests the Occurrence Report event category should be upgraded from an off-normal occurrence to an unusual occurrence.**

An unusual occurrence is a non-emergency occurrence that exceeds the off-normal threshold, and is related to safety, safeguards and security, environmental or health protection, or performance or operation of a facility. The February 8, 2001, event satisfied the requirements of an off-normal occurrence under nature of occurrence category Fire/Explosion (B (2)), because the unplanned fire took longer than ten minutes to extinguish after fire protection personnel arrived. However, the existence of significant safety problems before and during fire response activities justifies upgrading the classification to an unusual occurrence (using the “nature of occurrence category” Cross-Category — Potential Concerns and Issues).

The AHA neither delineated the conditions under which burning operations could be initiated, nor specified the appropriate response by the contractor to a woodland fire. Such responses would include the need to define the use, training, and protection of contractor operators and laborers in firefighting efforts. Although only one operator sustained minor injuries when cutting the firebreak, his injuries indicate that he was too close to the fire, and the investigation discovered that he was not properly trained or equipped to perform this task under fire emergency conditions.

Several opportunities for improvement have been identified, and are intended to assist line management in identifying options, potential solutions, and enhancements to their wildland fire safety program. Responsible DOE and contractor line management should review and evaluate the opportunities for improvement enumerated below, and consider incorporating these into the implementation plan that the site is developing in response to the *Initial Joint Review of Wildland Fire Safety at DOE Sites*. Opportunities for improvement are not intended to limit the initiatives and good judgment of line managers. Line management is ultimately responsible for safety and should use their experience and judgment in developing corrective actions in accordance with site-specific programmatic and ES&H objectives. The following opportunities for improvement are applicable to the full spectrum of activities conducted at the ORR.

- **OR should proactively identify and formally document unique hazards and corresponding safeguards and controls.**

DOE Order 420.1, *Facility Safety*, requires contractors to develop fire protection policies and procedures where DOE and industry standards are unavailable and a need exists. However, this provision of the Order was not implemented as part of the EMWMF project.

Although a set of fire safety standards was developed for the land clearing and grubbing activities at the EMWMF construction site, and includes the Code of Federal Regulations requirements and National Fire Protection Association standards, the established standards contain no explicit criteria for fire protection related to grubbing. Additionally, though DOE sites have developed in-house "prescribed burn" and "controlled burn" procedures, no such criteria exists in the current standards. The ORNL Forestry Management Group controlled burn procedure, for example, was not included in the standard set for the EMWMF project. OR should ensure that established fire safety standards include

documented safeguards and controls relevant to all wildland fire safety activities.

- **Responsibilities for all OR, BJC, and contractor personnel with emergency response roles should be clearly defined and well understood prior to implementing work.**

Before any activities are initiated, OR and BJC should ensure that all emergency response roles and responsibilities are delineated for project-specific personnel and site-wide emergency responders. Contractor and subcontractor project-related emergency response responsibilities and organizational site-wide roles (e.g., fire department and forestry management organizations) should be captured in project-specific operating documents, such as the emergency response plan, authorization basis, contractual scope of work, and memoranda of agreement. This will ensure the availability of adequate numbers of personnel and equipment to address the spectrum of emergency response situations possible, as identified in the AHA. Additionally, the Headquarters Office of Science, having landlord responsibility for the ORR, should ensure that emergency responses are formally communicated, and that associated responsibilities are clearly defined in applicable documents governing the roles of organizations providing reservation-wide services.



Spallation Neutron Source Site Burn Pit

- **OR should ensure that contracts and subcontracts that require open burning of debris, including privatized work, contain adequate safety requirements and controls.**

Integrated safety management core functions and applicable DOE and industry standards and requirements should be contractually transmitted by OR to contractor and subcontractor organizations performing land-clearing and related construction activities requiring burning of debris. OR should ensure that these contracts contain provisions for DOE and contractor oversight, and a requirement to analyze whether special controls are needed (e.g., burn pits, increased buffer zones, and pre-established firebreaks) for burns performed in close proximity to woodlands.

- **OR should review the training requirements for DOE and contractor personnel who have oversight responsibilities.**

As the ORR continues to place more emphasis on waste management and environmental restoration activities, it is imperative that training requirements are consistent with changing needs. OR, in conjunction with BJC, should scrutinize their respective training qualifications programs to ensure that they are commensurate with all "hot work" performed at the site, with emphasis on "non-facility" activities generally not associated with customary tasks and historic operations. OR and BJC should review both oversight and worker personnel training qualifications for applicability to the work being performed under normal operations and emergency conditions.

- **BJC and privatization subcontractors should enhance the implementation of integrated safety management practices by involving subject matter experts.**

The contractor's AHA development procedure referenced the need for subject matter expert involvement, although a fire safety subject matter expert was not explicitly required. There was no evidence that a fire safety professional was involved in developing the AHA or reviewing the work activity at the EMWMF site. The absence of fire protection subject matter expert involvement contributed to the lack of comprehensiveness and rigor in the AHA, and the inadequacy of fire safety features.

- **OR should ensure that a single, qualified organization is empowered with responsibility for planning and controlling burns on the ORR.**

A single organization should be empowered for institutionalizing and applying appropriate protocols and procedures for all aspects of open burning, including fire planning, control, and emergency management at the ORR. The ORNL Forestry Management Group has the requisite knowledge, experience, equipment, and capability to assume this role, and should be considered for this assignment. Accordingly, DOE Headquarters and OR roles, responsibilities, and authorities should be clarified for reservation-wide projects that involve burning activities, consistent with the authority of the empowered organization.

- **OR should ensure that a comprehensive "fuels management" plan is in effect for forested areas of the ORR.**

Slash from commercial logging activities contributes significantly to the fire threat. In fact, uncollected slash contributed to the February 8, 2001, open burning event. In addition, woodlands on the ORR are infested with the southern pine bark beetle, and large numbers of pine trees are dead, contributing significantly to the combustible loading of wildlands. A comprehensive plan has been developed by the ORNL Forestry Management Group to control combustibles by selective cutting and reduction of slash. The decision to approve funding and authorize work to proceed should be addressed promptly, as the woodland fire season is approaching.

- **DOE Headquarters should revise existing environmental and fire safety orders to comprehensively address wildland fire safety.**

In response to the year 2000 wildfires, the DOE imposed an open-ended moratorium on "prescribed fires (i.e., controlled burning) activities." Termination of this moratorium was contingent upon the completion of a comprehensive "review of existing policies, procedures, processes, and criteria" and the "develop[ment], as necessary, [of] Department-wide policy and guidance" on prescribed burning. The DOE has adopted an interagency agreement governing wildland fire safety. The Office of Environment, Safety and Health should develop interim guidance and a department-wide policy on wildland fire safety.

APPENDIX

TEAM COMPOSITION

The team membership, composition, and responsibilities are as follows:

**Deputy Assistant Secretary for
Independent Environment, Safety, and
Health Oversight**

S. David Stadler, Ph.D.

**Associate Deputy Assistant Secretary
for Independent Environment, Safety,
and Health Oversight – Operations**

Raymond Hardwick

Team Leader

Frank Russo

Evaluation Team

William Miller
Dennis Kubicki
David Berkey
Kirk Russell
Jose Maisonet, Technical Observer

Administrative Support

Barbara Harshman
Robert McCallum
Marcia Taylor
Jill Turner

Quality Review Board

Raymond Hardwick
Patricia Worthington, Ph.D.
William Eckroade